Community Based Monitoring and potential links with National REDD+ MRV

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Input paper no 1 for the FCPF workshop

¨Linking community monitoring with national MRV for REDD+¨

12-14 September 2011, Mexico City

THE WORLD BANK

UNAM

Background

The United Nations Framework Convention on Climate Change (UNFCCC) has outlined a mechanism that aims to reduce greenhouse gas emission from deforestation and degradation, to enhance the forest carbon stocks and promote the conservation and sustainable management of forests (UNFCCC 2009).National REDD+ activities should foster sub-national implementation and engage with national-level greenhouse-gas (GHG) estimation, accounting to monitor and to verify the performance of REDD+ activity within the country. This requires a reliable, up-to-date and credible system for monitoring, reporting and verifying (MRV) of forests and associated carbon stock changes. Following the current guidance, an MRV system for REDD+ activities will need to take into account:

1. International requirements for estimation and reporting, as outlined in the guidance, principles and procedures for estimating and reporting carbon emissions and removals at the national level, set out in the Intergovernmental Panel on Climate Change (IPCC) Good Practice Guidelines and Guidance for reporting at the international level (Penman et al. 2003, Eggleston 2006).
2. National characteristics, in particular, the drivers and activities causing forest carbon change and the particulars of the REDD+ implementation strategy. The different ways in which various activities affect the forest canopy and carbon have different implications regarding the appropriate ways of monitoring
3. The national capacities for MRV that should be based on an assessment of the gap between the existing national forest monitoring system and the requirements of a REDD+ MRV system; a roadmap needs to set out steps to put in place an effective, efficient and sustainable institutional and implementation framework for:
    - measuring and monitoring at different levels,
    - supporting national policies and REDD+ actions,
    - International reporting and verification.

It is clear that participation in REDD+ requires much more emphasis on measuring, reporting and verifying (MRV) that has been the norm in most national and local forest monitoring to date. Also without clear links between REDD+ MRV and policy from the outset, it will be difficult to develop REDD+ compensation schemes that are based on results. In that context community based monitoring (CBM)has been proposed as an additional and effective way to reduce costs and increase the reliability of forest monitoring data (Skutsch et al. 2009, Danielsen et al. 2011, Fry 2011) and to enhance ways in REDD+ implementation on the local level. In general, data coming from communities can support monitoring deforestation, degradation, and for measuring forest enhancement, as well as for independent verification of other forest carbon estimates and thus for improving the detail and accuracy of forest monitoring. The involvement of communities also increases the sense of local ownership towards the forest management. Traditionally, local-scale community-based monitoring have not really been linked to national level activities. The objective of this contribution is to highlight specific issues and challenges of CBM and to provide a conceptual framework to link CBM to national REDD+ MRV.

Why should local communities engage in monitoring?

Monitoring carried out by local people, communities and non-experts not only provides an additional level of data and information but also promotes the sustainability of any local implementation activity at a wider level(Whitelaw et al. 2003, Garcia and Lescuyer 2008). There are a number of valid reasons to involve the community in forest monitoring process (Fröde and Masara 2007):

Local knowledge: Local communities have in-depth understanding of the local forest, and tree species nearby. They can provide access to indigenous knowledge systems which can be used for sustainable forest management.

Communities are on spot: Generally, communities have easy access to the surroundings which are to be monitored, and regular field visits take less time and fewer resources, compared to surveys carried out by external experts.

Communities need to be involved: Any local implementation that affects forest of or used by communities needs their involvement, to be effective. Involvement increases the sense of ownership and responsibility. Active involvement of community in monitoring process may promote long-term sustainability of the program.

The role of CBM within a national level process depends very much, however, on the drivers and activities to be monitored. Table 1 summarises the potential role of CBM within a national MRV process.

Forest area change and associated carbon stock changes from reforestation and deforestation is commonly monitored by remote sensing and national forest inventory data sets at national level (GOFC-GOLD 2010). However, even in these cases there may be important contributions from the community level:

1. REDD+ requires tracking changes in human activities: local people can help this by signalling change events, when they happen, and especially, why - this information can be particularly useful when provided in near-real time.
2. REDD+ requires information about long-term performance: the capacity of communities to regularly re-visit sites over long-time periods means that implementation activities can be checked and verified.
3. REDD+ MRV requires consistency, accuracy, comparability and transparency: the data and information coming from communities provides an additional independent data source that can serve as reference and validation for national datasets such as those originating from remote sensing

Table 1: Potential role of community based monitoring

<table>
<tr><th colspan="2">Forest Change Activity</th><th>Monitoring Options at National Level</th><th>Potential Contribution of Community Based Monitoring</th></tr>
<tr><td colspan="2">Reforestation</td><td>• Remote sensing,
• National forest inventory
• Monitoring through forestry companies</td><td rowspan="3">• Acquiring/signalling the location, time, area and type of change events (in near real time)
• Ground level measurements for local implementation (i.e. of reforestation plots)
• Independent local reference for national/other data sources</td></tr>
<tr><td colspan="2">Deforestation</td><td>• Remote sensing
• National forest inventory</td></tr>
<tr><td rowspan="3">Forest degradation</td><td>Commercial activities, incl. selective logging</td><td>• National forest inventory
• Commercial companies (i.e. harvest estimates)
• Remote sensing</td></tr>
<tr><td>Wild fire</td><td>• Remote sensing, National forest inventory</td><td>• Acquiring/signalling location, date, area and type ofchange event (in near real time)</td></tr>
<tr><td>Subsistence forest use incl. fuel wood, charcoal, community forest management etc.</td><td rowspan="2">• Limited historical data
• Possibly national forest inventory</td><td rowspan="2">• Regular ground level measurements and reporting of forests and carbon stocks
• Tracking growth/decrease of local activities (drivers)</td></tr>
<tr><td>Forest enhance-ment</td><td>Increases in biomass due to REDD+ activities at project level</td></tr>
</table>

Thus, while remote sensing techniques are the main tools used at the national level to detect forest deforestation, local level community data could be an important input to analysis of deforestation and (commercial) degradation events. CBM can help to verify remote sensing estimates and to signal new changes (even before the remote sensing data have been analysed). Important information could be location, time, area and type of the change events (in near real time

CBM may be even more helpful, however, when it comes to locally-driven and small scale forest degradation caused for example by subsidence fuel wood collection, charcoal extraction and grazing in the forest. The impacts of these activities are rarely captured accurately in national databases or from remote sensing. In these cases, data acquired by communities is often essential, and can include reporting on incidence of change events, as well as ground measurements on carbon stock changes for tracking and reporting on local REDD+ implementation activities. There are many examples which show that communities can carry out such monitoring (Danielsen et al. 2011, Danielsen et al. 2010, Fry 2011, Verplanke and Zahabu 2009).

What can local communities monitor?

Forest change and carbon stock data can be acquired in many ways. A matrix (shown in Table 2) should help to focus on discussion and to evaluate the role of community acquired data compared with other monitoring data sources.

Forest inventory is carried out on the national level to collect ground-based measurements (such as tree height, diameter at breast height (DBH) and tree species) on plots selected through a sampling design, and uses these to estimate forest carbon stocks using allometric relationships. This process can be expensive and time consuming and few developing countries have comprehensive forest inventories that allow for national forest carbon stock estimates (DeFries et al. 2007).Experience gained from studies conducted in Ghana and Tanzania (Brashares and Sam 2005, Danielsen et al. 2011) and Philippines (Uychiaoco et al. 2005) shows that communities themselves can collect some local forest inventory data adequately and at reduced cost than professional foresters. With proper field measurement equipment, hardware (GPS, PDA, smart phone) and software (user friendly data form) plus training,it has been shown that local communities can measure the basic variables such as DBH, height, tree species, and tree count; and most importantly, they can repeat this on a regular basis. The collected data has proven to be of a level of precision comparable to that produced by professional forest inventory staff(Skutsch et al. 2009, Verplanke and Zahabu 2009).

This ability may be useful both to quantify changes in rates of degradation within forests and to quantify rates of forest enhancement, particularly in areas that under community management. In particular it will be essential for performance reporting on local REDD+ implementation activities to address causes of forest degradation such as fuel wood collection or grazing, and to measure the impacts of improved community forest management. Forest inventory type measurements for forest enhancement, for example, maybe repeated each year and sites allocated for reforestation or sustainable management can be regularly checked. Even a proof of “no change” is an important finding to ensure that new activities do not negatively affect the carbon performance in REDD+ implementation.

Table 2: Matrix to compare and evaluate the quality of community acquired data with existing remote sensing and professional based monitoring approaches on the national level {adopted from(GOFC-GOLD 2010, Achard et al. 2008, Danielsen et al. 2011)}.

Acquisition type	Forest Inventory				Deforestation Area			DegradationArea				Cost per Area
	DBH	Height	Tree species	Number of tree per plot	Clearing for commercial purpose, agriculture forestry	Subsistence Agriculture	Infrastructure expansion (Road, mines, urban etc.)	Selective logging	Fuel wood	Forest grazing	Wildfire	
Coarse resolution (250- 1000m)	-	-	-	-	+	-	+	+	-	-	++	+
Medium resolution (10-60 m)	-	-	-	-	+++	++	+++	+	-	-	++	+
Fine resolution (<5m)	-	-	-	++	+++	+++	+++	++	+	++	++	++
Airborne laser scanning	-	+++	-	++	+++	+++	+++	++	++	++	++	++
Terrestrial Laser scanning	+++	++	-	++	++	+	++	+	+	+	+	+++
Synthetic-aperture radar (SAR)	-	+	-	-	+++	++	+++	+	-	-	++	++
Community based monitoring	++	+	++	++	+	+	+	+	+++	++	++	+
Professional forest inventory	+++	+++	+++	+++	++	++	++	+++	++	+	+	++

Quality indicator: (-): no, (+) low, (++) medium, (+++) high

How to integrate local and national monitoring?

Opportunities to link local and national REDD+ monitoring are best explained by thinking about contributions and relative benefits. If both sides contribute and benefit at the same time, a win-win situation can be created that can help to stimulate a suitable level of collaboration. GOFC-GOLD(2010) provides some general guidance for evolving CBM and for conceptualising how communities can be linked in to national MRV in a mutually beneficial way. In this, it is assumed that all monitoring processes need to follow the principle of consistency, transparency, comparability, completeness and accuracy(Eggleston 2006, GOFC-GOLD 2010).

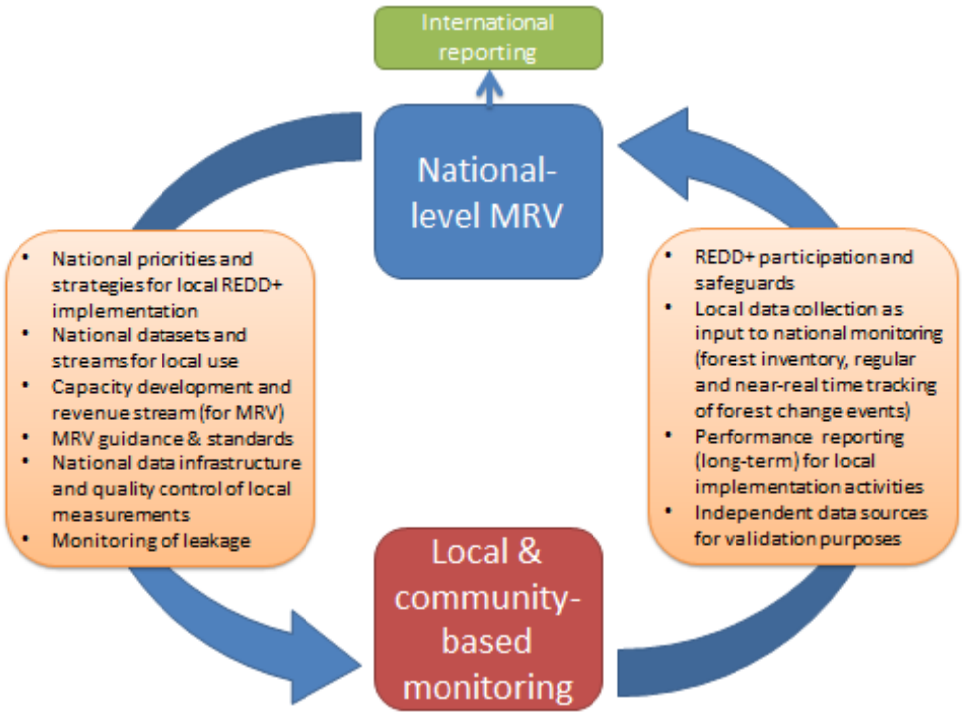

Figure 1. Some contributions and benefits on community based monitoring for national REDD+ MRV

Figure 1 highlights some of the contributions and potential benefits of linking CBM with national REDD+ MRV. Clearly, this relationship is likely to work best in countries where the engagement of communities to address local drivers has been identified as key component in the national REDD+ strategy. In this case, the national level is expected to provide strategies, incentives and policies which stimulate such community involvement in REDD+ implementation. Existing national data (i.e. maps, remote sensing images etc.) may be utilised (e.g. to identify areas at risk of deforestation/degradation, or to identify areas of potential forest enhancement), capacity development (both for forest management and for monitoring) can be provided and potential revenue stream can be identified to support local efforts. In addition, the national level would need to provide a data infrastructure system such that locally acquired data could be uploaded, verified, disseminated and shared, such that is may continuously improve the national monitoring efforts. Only national scale monitoring is however capable of properly accounting for the displacement of emissions

(leakage), and national monitoring thus can provide a service to local level activities so that they do not have to deal with those issues specifically.

In order for CBM to make an important contribution to the national level emission reporting, number of issues need to be considered. Firstly, there should be some standards and guidelines for data acquisition at community level, such that the same systems are used by communities all over the country. Secondly, communities should be made aware of the value of monitoring and trained in monitoring activities and related issues. Local data can be acquired using different hand held technologies such as smart phones, tablet personal computers (tablet PC), personal digital assistant (PDA) devices with integration of GPS, cameras etc. provided these have user friendly interfaces(Parr et al. 2002). Thirdly, The national implementing agencies would need to develop a robust systems to collect the locally monitored data. In brief, a national level strategy to process local data can be summarized as follows:

1. *Data collecting system:* The national level should design a system/protocol to collect and report CBM data. The community can easily provide these data to national data repository if internet access or wireless networks are available.
2. *Integrating local data into national databases:* National authorities should also develop means for inspection/checking overall data veracity and consistency, i.e. a functional mechanism to evaluate the quality of locally collected data. The local data, if meeting all the national requirements, can be integrated into the national database. The national database will be used for an analysis to identify both areas where forest cover has changed and changing stocks within forests.
3. *Information processing and analysis:* The information will be processed and analysedand feed into estimations on emissions and removals at the national level. The results can be reported (i.e. in a format using the IPCC GPG) to an international body for carbon crediting.

Quality control is one of the central goals of the data exchange, and this goes both ways. Table 2 shows that there is often more than one type of observation available for each parameter and thus data should be checked and (as far as practicable) validated using an independent source. In this sense Light Detection And Ranging(LiDAR), fine resolution satellite data and professional forest inventory can be used in selected cases to check the monitoring provided communities. At the same time, local data on forest change events can be used to assess the quality of national forest area change monitoring using remote sensing. An open exchange and access to data is fundamental and important to ensure the issue of transparency.

A limitation of CBM is that it will only be available for areas in which communities are present and are actively engaged in forest management and/or REDD+ activities. This means that at least in the short term, some parts of the country will be able to benefit from CBM while others will not. However, given that one of the major strengths of CBM is in assessing impacts of community related degradation activities and impacts of improved community forest management, then there should be a spatial convergence in this regard. Clearly, an aim should be to involve as many communities as possible in improved forest management

activities and to ensure that monitoring is adopted as one of the activity within the management plan.

Reference emission levels (REL) and approaches to match them from local to national level

Generally, countries will be required to develop a national reference emission level (REL) as a base line against which to measure future emissions in the accounting period. Countries may consider various circumstances such as historical rates of deforestation, forest cover changes and national characteristics to define their RELs (UNFCCC 2009). Countries may also define multiple RELs (e.g. for degradation as well as for deforestation) at national or sub national levels but these baselines must be coherent and consistent. Local participation is necessary for the successful development of such activities(Ros-Tonen et al. 2008, Dalle et al. 2006). Irawan and Tocconi (2009) identified the following options for developing and integrating the local level in the implementation of a national REL: :

1. National level can decide the national reference level and involve the local level authorities in the implementation of national REDD+ activities;
2. National level can decide on a national reference level and pursue expressions of interest from local level authorities to implement REDD in their administrative areas;
3. National level and local level authorities decide on a national reference level jointly and the local level authorities implement REDD measures at the local level.

Irawan and Tacconi(2009) showed that in each option, local level involvement is essential to ensure successful implementation. However, disaggregating a national reference level down to the local level may give some problems.

Safeguards

The issue of safeguards and its consideration and monitoring also concerns community involvement. On the environmental side, such safeguards include the displacement of emissions or leakage (which has been briefly dealt with above), risks of reversals (permanence) and issues of biodiversity. Permanence and maintenance of biodiversity may be best ensured if communities benefit more from conserving their forests than destroying them, and as noted above, monitoring is one of the ways to encourage this. Social safeguards include respect for the rights of forest dependent people and assurance that local people will not suffer as a result of REDD activities. Clearly there is a role for community monitoring in all these aspects, but this described in parallel paper prepared for this workshop.

Conclusion

Community based monitoring (CBM) can be a vital data source in REDD+ monitoring, and integration with national REDD+ reporting and implementation could create joint benefits. The main niches identified as regards the role of community based data within a national MRV system are:

- Signalling the occurrence of change events (deforestation/commercial degradation)

- Providing ground truthing for nationally monitored data (verification of land use change assessments made from remote sensing, e.g. areas degraded/deforested)
- Identification of drivers of degradation and deforestation and changes in these driver activities and impacts
- Ground level measurements of on-going degradation processes in areas under community use (quantitative assessment of carbon stock decreases over time)
- Ground level measurements of impacts of projects for improved community management under REDD+ (quantitative assessment of forest enhancement)
- Contribution of data for the construction of local level baselines which could possibly be used in the construction of national level reference emission levels

The main ways in which the national MRV system could support community involvement in REDD+ are:

- Identification of areas of threat of deforestation and degradation where community management and monitoring could be usefully employed
- Accounting for leakage
- Providing standard procedures and use of available national data sources to support communities in monitoring activities
- Capacity development and adding value and quality control for community acquired data
- Development of statistical evidence on the effectiveness of community approaches to forest management under REDD+, and their impact on carbon stocks.

To make local data useful on the national there are however a number of key technical issues to be addressed. Common guidance and standards for data collection are essential, as well as an open and efficient data exchange and quality control mechanism.

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